$\mu_1, \mu_2 \ldots \mu_m$, and on p. 150 $f(x)$ has been printed instead of $f'(x)$. On p. 73 the phrase "en outre" is an imperfect equivalent for "wir setzen noch," and is likely to make the reader suppose that the symbol $\Phi(x, \xi)$ has been already defined. The handsome appearance of the volume, and the excellence of the printing, fully maintain M. Gauthier-Villars' high reputation.

The first edition of the "Lehrbuch" was reviewed in this journal at considerable length, so that it is unnecessary to give here any detailed account of the contents of this volume. Prof. Weber has introduced various improvements in detail, and added, amongst other things, an account of Lagrange's interpolation formula, and of Hurwitz's very interesting researches on Sturm's theorem. The extreme value and originality of the treatise become more evident the more carefully it is studied; the appearance of this translation, as well as that of the second edition at home, indicates that its great merits are being duly appreciated. G. B. M.

A Manual of the Grasses of New South Wales. By J. H. Maiden. (Sydney: Gullick, 1898.)

BROUGHT out under the authority of the Minister for Mines and Agriculture for New South Wales, the Government botanist publishes a very useful account of the grasses of the Colony. The number of species indigenous to the Colony is stated at 196, comprised in 56 genera. These numbers may be compared with the 95 species belonging to 48 genera reckoned by Hooker as natives of these islands. Under each species, in addition to the technical diagnosis, the vernacular names are given, with a reference to the published figures; the habitat and range of the species, and an account of its value for fodder and for other purposes. Then follows a key to the genera, and under each genus a key to the species. In the case of a number of the more useful or more common species, full-page illustrations are given. The volume is a very useful and valuable one; but, considering its purpose, it strikes us that its practical value would be increased by either a general description of the flower of grasses, or a glossary of technical terms; unless indeed, Australian farmers are much better acquainted than our own with botanical terminology.

Manuel de l'Explorateur. By E. Blim and Rollet de l'Isle. Pp. vii + 260. (Paris: Gauthier-Villars, 1899.)

THE object of this volume is to provide travellers in little-known regions with information which will enable them to record particulars of service to geography concerning the land traversed. In the first chapter the methods are described for determining and representing approximately the route followed and the details of the surface, using a prismatic compass and an aneroid. The astronomical observations required to define positions along the route are then explained, and it is shown how the combination of these observations with the rough survey enables an approximately accurate representation of the journey to be laid down. The determination of heights and distances by levelling and triangulation are described in the third chapter, for the instruction of explorers who wish to make a detailed study of particular districts. The two remaining chapters deal with systems of projection for the conversion of the observations to maps, and the choice and transport of the instruments referred to in the text. The sextant is not included among the instruments, the astronomical observations being made with the theodolite instead. No instructions are given as to what to observe in natural history, geology, anthropology, or other sciences; hence, the volume is not to be compared in value with the "Hints to Travellers" published by the Royal Geographical Society. Nevertheless, as a clear and very elementary manual on surveying and practical astronomy for travellers who explore without having received a preliminary scientific training, the book may prove of service.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Heredity and Fertility.

As Prof. Karl Pearson in his paper "On the Law of Ancestral Heredity," published in the *Proceedings* of the Royal Society, alludes to an investigation which he has apparently commenced into the inheritance of fertility in man, it may be of interest now to publish one which I completed some years ago, but which for various reasons has not appeared in print.

The problem to be solved was:—Do marriages of heiresses prove more or less fertile than ordinary marriages? The first desideratum was of course to get a practically homogeneous class from which to obtain the necessary data. The families enrolled in "Burke's Peerage and Baronetage" sufficed. Taking the volume for 1892—just published when this investigation was commenced—there were in it of the present generation 265 ordinary or non-heiress marriages which had produced an average of 3·8 children per marriage, forty-eight of which, or 18·5 per cent., were absolutely sterile.

Now an heiress, so called in "Burke," may be considered of the same class as an only child. Hence, taking care that both parents lived long enough after the birth of their first child to have had others, I extracted all the marriages of heiresses and female only children that occurred in "Burke" for the present generation, with the addition of a considerable number from the past generation contained in "The Lineage." There resulted:—243 marriages, averaging 3·74 children per marriage and 11·9 per cent. marriages absolutely sterile. These figures show that there is practically no difference in the fertility of ordinary marriages—3·8 per marriage—and the 3·74 fertility of heiresses and only children: the small difference of six-hundredths per cent., on so small a number as 250 marriages, being well within the ordinary limits of error. It implies that with greater numbers the results would probably be similar. Not so, however, when we come to consider the number of marriages which are absolutely sterile, for these are so much fewer with the only children marriages—6·6 per cent.—that we must say when they are fertile they are more fertile than the others.

But the problem may be attacked from the other side. If female members of the smallest families possible tend to bear fewer children than the female members of families of ordinary size, the female members of large families would tend to bear large families. Is this so? With a much greater amount of labour than would be imagined, I extracted from the same work some marriages of ladies who were members of families of five or more, *i.e.* had in each case four or more brothers or sisters, with the result that 250 marriages averaged 4·25 per marriage with 13·6 marriages quite sterile.

Summarising, we get then ladies of small families average 4·06 children per marriage, 11·1 per cent. marriages being quite sterile.

Ladies of ordinary families average 3·8 per marriage, 18·5 quite sterile.

Ladies of large families average 4·25 per marriage, 13·6 quite sterile.

This shows that the more contrasted the ladies are as regards number of brothers and sisters, the more nearly allied are the numbers of their children and the relative amount of absolute sterility. A conclusion tending to show that the cause under investigation is not a *vera causa*.

Does the female influence show itself in a change in the proportion of male to female children, assuming of course a chance distribution of the husbands as being members of small, ordinary, and large families?

	Sons.	Daughters.	Total	S. to 100 D.	Sterile.
243 heiress and only-child marriages	492	414	906	107 sons	11
265 ordinary marriages ...	514	528	1042	97 sons	18·5
250 large family marriages	553	510	1063	108 sons	13·6

The same result as before—the most contrasted classes give the most similar results.

If heredity has anything to do with this matter, which so far seems improbable, it may arise from the other side—the father's. Hence I extracted marriages of only sons, of sons of ordinary

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marriages, and of sons who had four or more brothers or sisters, and found that :—

	Children per marriage.	Sons to 100 Daughters.	Sterile.
191 only sons	4·09	116 sons	8·4 per cent.
265 sons of ordinary families	3·8	97 sons	18·5 ,,
500 sons of large families..	3·8	110 sons	12·4 ,,

These results point rather to the conclusion that could have been surmised: only sons being usually better off, have no reason to restrict the size of their families, as is so often necessary where a fortune has to be divided among many, and hence they have larger families.

Adding the three separate parental classes together, we have :—

	Sons.	Daughters.	Total.	Per marr.	Sons to 100 Daughters.
434 F. and M. only children	912	776	1688	3·89	117
265 F. and M. ordi- families	514	528	1042	3·9	97
750 F. and M. large families	1558	1424	2982	3·98	109
			5712		

Which shows that the number of children per marriage is so nearly similar that with a larger number of marriages to deal with they would probably be the same. Comparing the figures in the last column brings forth the most curious result of the investigation, that the marriages of members of ordinary sized families have a smaller proportion of sons to daughters than in the case of the other marriages.

The size of the families of the various classes dealt with may prove of interest, although nothing of great importance can apparently be drawn from the figures. The table contains the percentage of children per hundred marriages :—

Number of family.	Sterile. 0	1, 2	3, 4	5, 6	7, 8	9 & over.
Marriages of—						
Only female child ...	11	26	26	24	9	4
Only male	9	30	25	15	12	9
Ordinary	18	19	24	18	11	10
Daughter of large families	14	23	16	19	12	14
Son of large families ...	12	26	25	18	10	8
Total	64	123	117	95	54	42
Average	12·3	10·2	9·7	8	4·5	3·5

And, now, what are the final results to be drawn from the foregoing analysis? That, as a matter of fact, there is in no case a difference of sufficient magnitude to enable us to say that the fertility of either male or female in the human race is in any way correlated to the fertility of their fathers or mothers, and *a fortiori* correlated to the fertility of their grandparents.

Churchfield, Edgbaston. F. HOWARD COLLINS.

"A Short History of Scientific Education."

IN Sir Norman Lockyer's address, under the above title, reprinted in NATURE of October 13, he is reported to have said: "Before the Reformation the universities were priestly institutions, and derived their authority from the Popes. The universities were for the few; the education of the people, except in the various crafts, was unprovided for. The idea of a general education in secular subjects at the expense of the State or of communities is coeval with the Reformation. In Germany, even before the time of Luther, it was undreamt of, or rather, perhaps, one should say, the question was decided in the negative." . . . "With the Reformation this idea spread to France."

The whole passage seems to have been taken from that travesty of "The History of Pedagogy" compiled by Dr. Gabriel Compayré (compare pp. 114–115 and 120), and it is unfortunate that Sir Norman Lockyer should have followed so untrustworthy a guide.

For the statements contained in the above-quoted sentences are in direct opposition to the facts as ascertained by the best authorities in the matter. It is quite true that education owes much to the bishops and monks of the centuries before the Reformation, for it was in the episcopal seminaries, which formed a part of the bishop's own household, and in the great monastic schools, such as those of Cluny, Bec, St. Gall, and numerous others, that the torch of learning was kept alight in the troublous times when the laity were mostly fighting to resist the incursions of barbarians, or warring one with the other.

The priestly influence was therefore an influence for good. More than this, such Popes as Innocent III., Honorius III., Benedict XII., Gregory IX., Urban IV., to name no others, deserve the gratitude of mankind of all ages for their persevering efforts to improve the state of learning in the schools and universities of their times. Sir Norman Lockyer tells us that the "universities were for the few." How is this statement to be reconciled with the fact that students flocked to the universities in the days before the Reformation in multitudes so great, that we find it reported, that in the thirteenth century some ten thousand scholars attended the classes of the University of Bologna at one time, with another forty thousand at Paris, and thirty thousand at Oxford, while at Bordeaux a single college boasted of upwards of two thousand scholars. Even allowing that the numbers are exaggerated, it is indisputable that in this century the universities were crowded with students. Nor were these scholars all clerics, nor yet the sons of the nobles and well-to-do citizens, but mostly poor men—a scholar and a poor man being almost synonymous terms. Does not our own Chaucer describe the Clerk of Oxenford as "full hollow and threadbare?" And this, too, at a period when printed books were either altogether wanting or were a rarity. The number of universities founded in Europe in pre-Reformation days has been reckoned as sixty-six.

And what is true of universities is true also of elementary and grammar schools. In this connection, the first essay of John Charles Tarver's collection, "Debateable Claims," is worth referring to. "Fifty years ago," he writes, "the Reformation was popularly regarded as the very first beginning of enlightenment. Up to that time a crass and brutish ignorance was supposed to have prevailed . . . Since the middle of this century this view of our history has been considerably modified . . . How were the middle classes taught before the Reformation? The popular view is that they were not taught at all till Henry VIII. and his children, especially Edward VI., reserved something from the spoils of the Church endowments for grammar schools. A more enlightened view holds that incidentally the monasteries themselves were teaching establishments, and especially that the friars were not only preachers, but teachers . . . we should hardly have expected to find that the period of the Reformation was a period of indifference to schools; it was more than that, it was a period when schools were suppressed" And further on: "Again, the Reformation in its later stages was distinctly an upheaval of ignorance: the value of the old methods of teaching was not understood; 'the baser sort,' armed with the text of the Bible, thought all other learning superfluous; they regarded it, as classical learning is regarded by the scientific smatterer of to-day, as antiquated and superstitious. In Germany, according to Dr. Scherer, this attitude of mind contributed to the Counter-reformation; for contempt of learning having destroyed the teachers, when in the fulness of time the want of them was felt, the Jesuits were ready to take their place." In Mr. Leach's "English Schools at the Reformation," we learn that in England about the year 1546 there was one grammar school for every 8000 people, instead of one for every 23,000, as was the case in 1865; so that, at least in England, it is not correct to state "that the education of the people was unprovided for."

And what is true of England is true of other countries. As a set-off to the reference made by Sir Norman Lockyer to Luther's laudable endeavours in the cause of free education for the people, let us take the following quotation from a decree drawn up in the days of the Anglo-Saxons. "Mass-priests shall always have in their houses a school of learners; and if any good man will trust his little ones to them for lore, they shall right gladly receive and kindly teach them. . . . They shall not, however, for such lore, demand anything of the parents, besides that which the latter may give of their own will." This decree first appears in the Council of Vaison, and re-appears in the acts of several Councils of England, France, and Italy: for instance, in the Carlovingian Council of Orleans, and in the Constitutions of Vercelli. The request of the States General of Orleans in 1560 to Francis II., quoted by Sir Norman Lockyer, is therefore nothing new in the matter of free education. In addition to the Constitutions of Vercelli, those of Dado of Verden, and Heraclius of Liege, ordain the establishment of "little" or parochial schools, wherein poor children of both sexes, about the age of seven years, are to be taught gratis. That free

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